
Stereotaxic surgery for excitotoxic lesion of specific brain areas in the adult rat.

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Public Summary:

Many behavioral functions in mammals, including rodents and humans, are mediated principally by discrete brain regions. A common method for discerning the function of various brain regions for behavior or other experimental outcomes is to implement a localized ablation of function. Excitotoxic lesion using stereotaxic surgery is one of the most reliable and practical methods of lesioning excitatory neurons without damaging local glial cells or traversing fibers. Here, we present a protocol for stereotaxic infusion of the excitotoxin, N-methyl-D-aspartate (NMDA), into the basolateral amygdala complex. The method can be adapted to other mammals, with the appropriate adjustments in equipment and coordinates, and is applicable to a variety of brain regions.

Scientific Abstract:

Many behavioral functions in mammals, including rodents and humans, are mediated principally by discrete brain regions. A common method for discerning the function of various brain regions for behavior or other experimental outcomes is to implement a localized ablation of function. In humans, patient populations with localized brain lesions are often studied for deficits, in hopes of revealing the underlying function of the damaged area. In rodents, one can experimentally induce lesions of specific brain regions. Lesion can be accomplished in several ways. Electrolytic lesions can cause localized damage but will damage a variety of cell types as well as traversing fibers from other brain regions that happen to be near the lesion site. Inducible genetic techniques using cell-type specific promoters may also enable site-specific targeting. These techniques are complex and not always practical depending on the target brain area. Excitotoxic lesion using stereotaxic surgery, by contrast, is one of the most reliable and practical methods of lesioning excitatory neurons without damaging local glial cells or traversing fibers. Here, we present a protocol for stereotaxic infusion of the excitotoxin, N-methyl-D-aspartate (NMDA), into the basolateral amygdala complex. Using anatomical indications, we apply stereotaxic coordinates to determine the location of our target brain region and lower an injection needle in place just above the target. We then infuse our excitotoxin into the brain, resulting in excitotoxic death of nearby neurons. While our experimental subject of choice is a rat, the same methods can be applied to other mammals, with the appropriate adjustments in equipment and coordinates. This method can be used on a variety of brain regions, including the basolateral amygdala, other amygdala nuclei, hippocampus, entorhinal cortex and prefrontal cortex. It can also be used to infuse biological compounds such as viral vectors. The basic stereotaxic technique could also be adapted for implantation of more permanent osmotic pumps, allowing more prolonged exposure to a compound of interest.

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